



GOBIERNO  
DE ESPAÑA

MINISTERIO  
DE AGRICULTURA, ALIMENTACIÓN  
Y MEDIO AMBIENTE



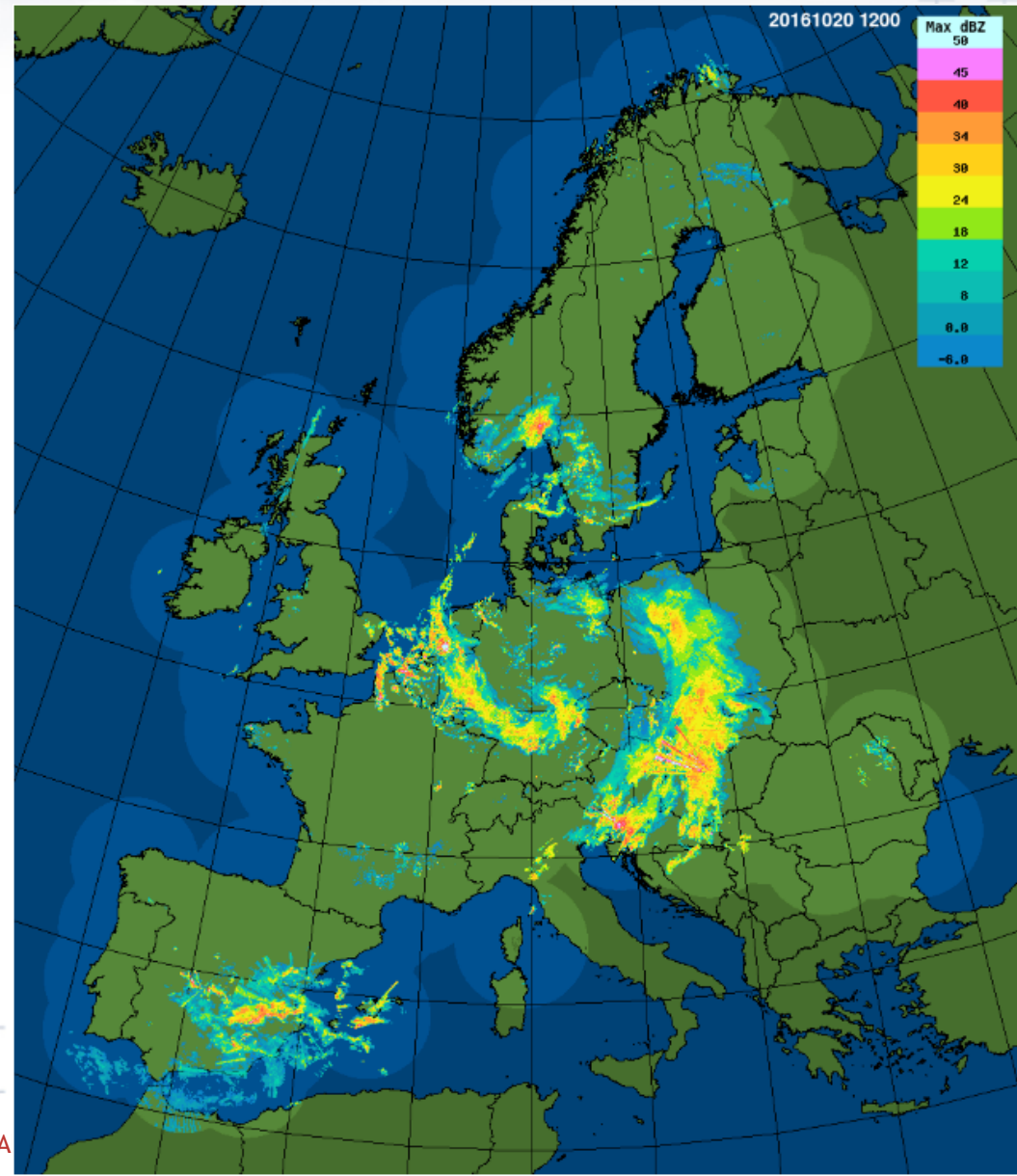
# Verification of hourly precipitation using OPERA dataset

**José A. García-Moya**

**Spanish Met Service - AEMET  
Hirlam/Aladin All Staff Meeting  
16 - 19 April 2018, Toulouse, France**

# Introduction

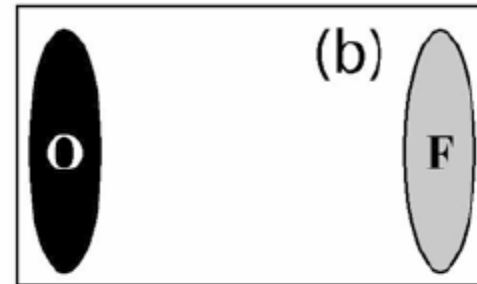
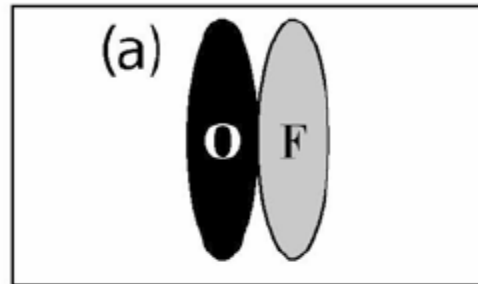
- The objectives of OPERA are:
  - to provide a European platform wherein expertise on operationally-oriented weather radar issues is exchanged;
  - to develop, generate and distribute high-quality pan-European weather radar composite products on an operational basis.
- Odyssey, the OPERA Data Centre, generates and archives composite products from raw single site radar data using common pre-processing and compositing algorithms.
- Odyssey creates 3 composite products:
  - Instantaneous Surface Rain Rate
  - Instantaneous Max Reflectivity
  - **1 Hour Rainfall Accumulation**



# Validation - SAL

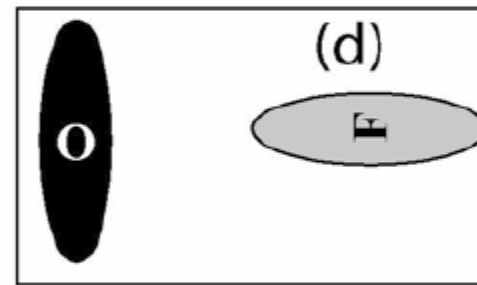
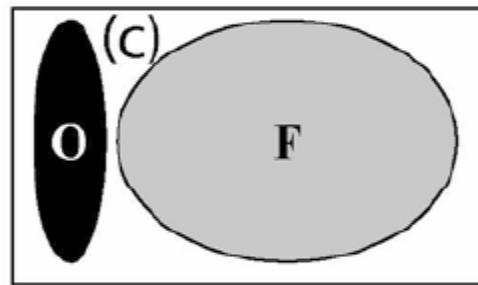
- Using OPERA as pseudo observations to verify NWP deterministic models:
  - ECWMF
    - 00, 06, 12 & 18 UTC runs
    - 12, 24, 36 & 48 h fcst – 3 h accumulated precipitation
    - Verification domain – Europe
  - AEMET – Harmonie operational model
    - 00, 06, 12 & 18 UTC runs
    - 12, 24, 36 & 48 h fcst – 1 h accumulated precipitation
    - Verification domain – Iberian Peninsula
  - AEMET – gSREPS individual members
    - 00 & 12 UTC runs
    - 36 h fcst – 3 h accumulated precipitation
    - Verification domain – Iberian Peninsula
- Period 2016120100 - 2017013123

$S = 0$   
 $A = 0$   
L small

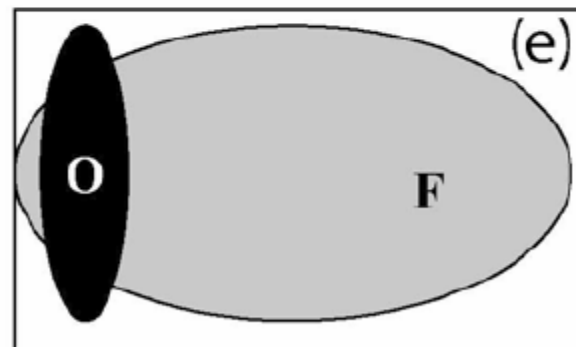


$S = 0$   
 $A = 0$   
L large

$S > 0$   
 $A = 0$   
L medium



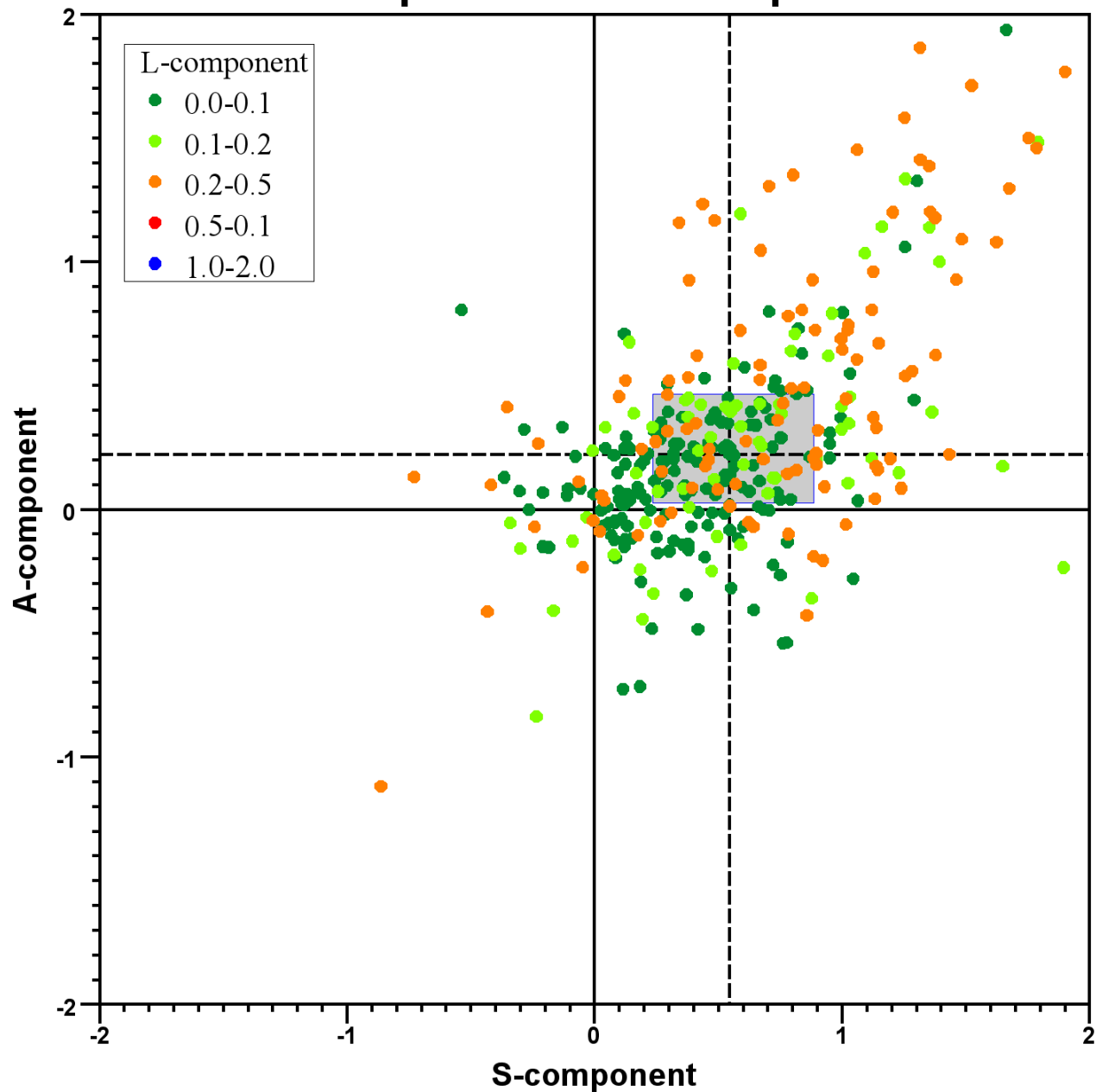
$S = 0$   
 $A = 0$   
L large



$S \gg 0$   
 $A = 0$   
L medium

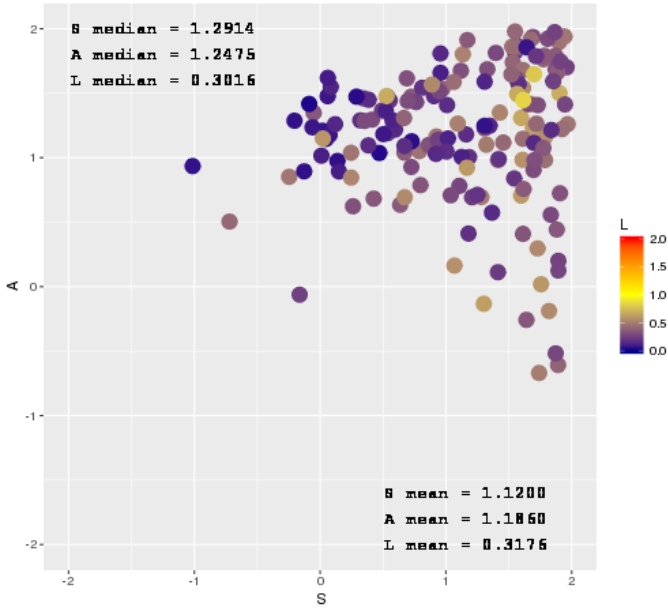
Davis et al. 2006

# Central Europe 2008 24hAccPcp : T799 T+54



# AEMET Harmonie Det - OPERA

SAL aemet  
20161201 - 20170228  
AccPcp1h

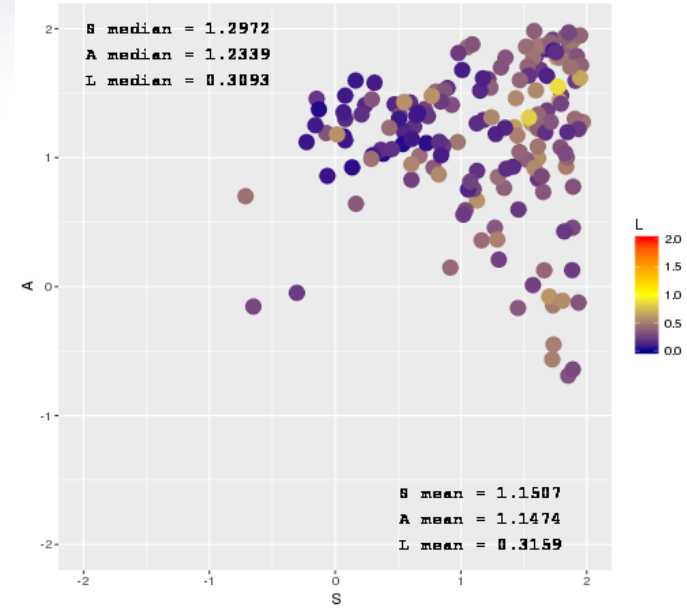


H+12 H+24

Acc. Precip. 1h

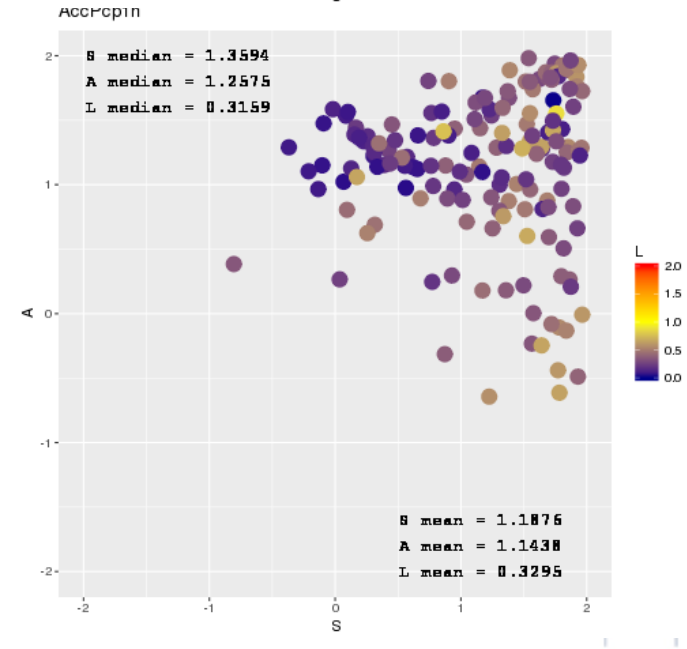
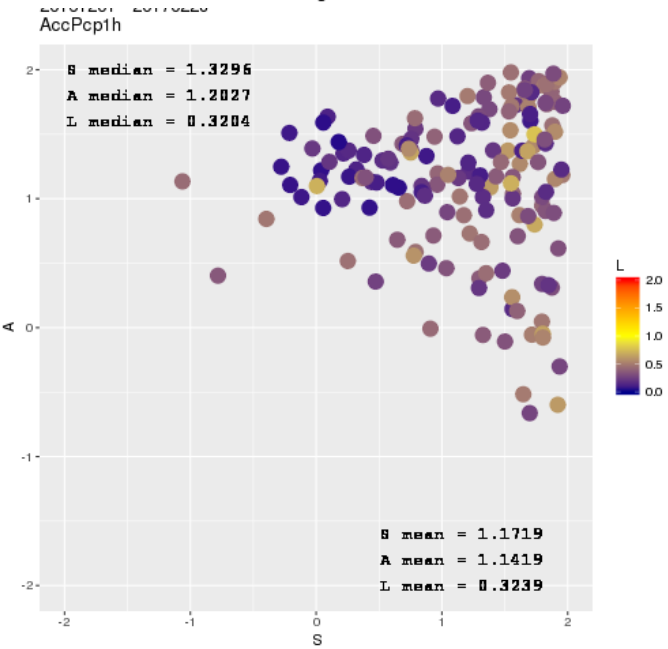
00,06,12 & 18 UTC

SAL aemet  
20161201 - 20170228  
AccPcp1h



Iberian Pen.

H+36 H+48



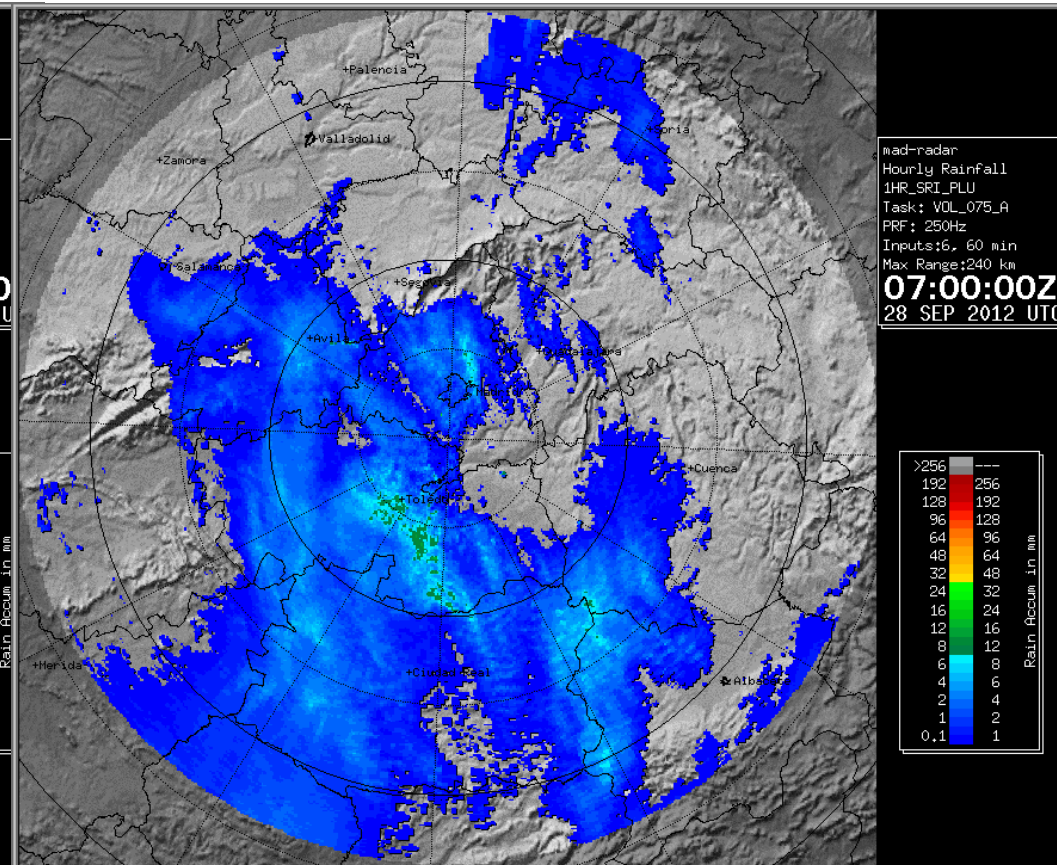
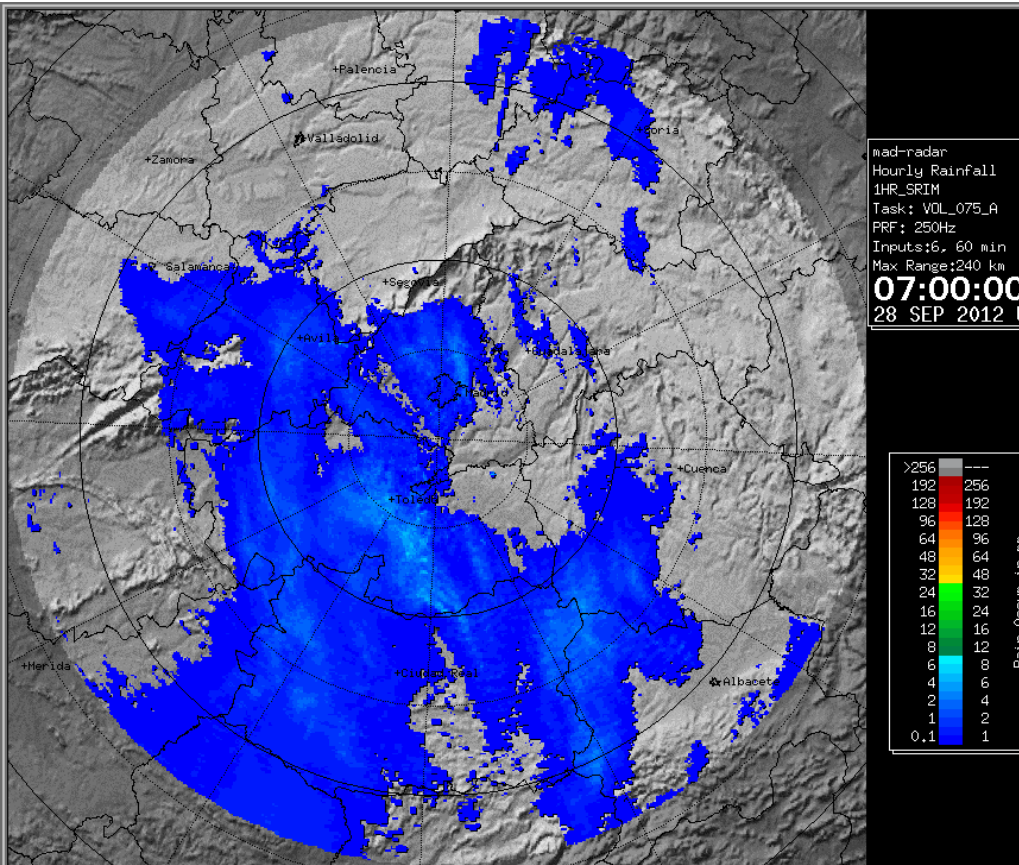
# Validation - HYDROP

- HYDROP is a pseudo precipitation product from AEMET radar network calibrated with AEMET precipitation observations in real time.
  - **“Real-time estimation of mean bias in radar rainfall data” -D. J. Seo et al. -Journal of Hydrology 223 (1999) 131-147.**
- Using HYDROP as pseudo model validated using observations from the AEMET automatic station network
- Obs: 1, 3, 6, 12 and 24 hours accumulated precipitation
- Period 2016120100 – 2017013123
- Converting hdf5 format to grib
- More observations than OPERA

# Example - HYDROP

Acumulación horaria 1HR\_SRIM -07:00 Z

Acumulación horaria 1HR\_SRIM\_PLU -07:00 Z



Credits: Jose Miguel Gutierrez - AEMET



# Validation – OPERA / HYDROP

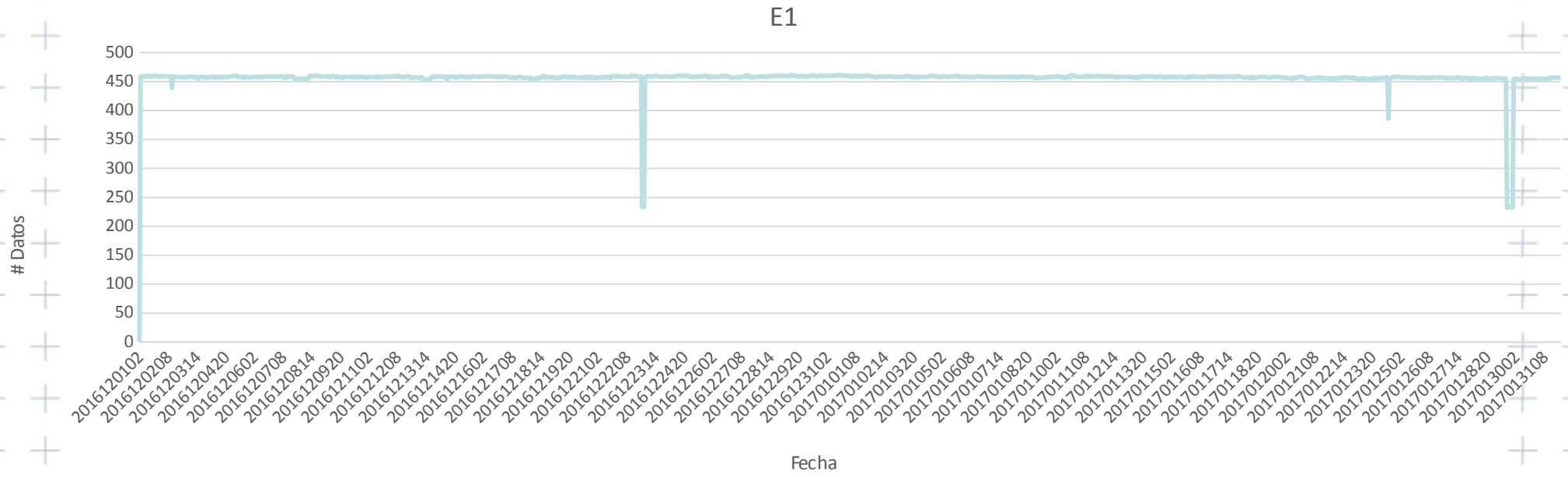
- Using OPERA/HYDROP data as pseudo model validated using observations from the AEMET automatic station network
- Obs: 1, 3, 6, 12, and 24 hours accumulated precipitation
- Period 2016120100 – 2017013123
- Converting hdf5 format to grib

# OPERA – Obs - Monitoring

- AEMET automatic station network.
- Acc. Precip. 1 h, 3 h, 6 h, 12 h and 24 h.
- A lot of no-data.

OPERA	2016120100	2017013123	
Pormedio	# Datos	Bias	RMSE
E1	678425	-0.05	1.02
E3	676983	-0.16	1.78
E6	674008	-0.32	3.18
E12	668014	-0.63	5.59
E24	655921	-1.30	9.41

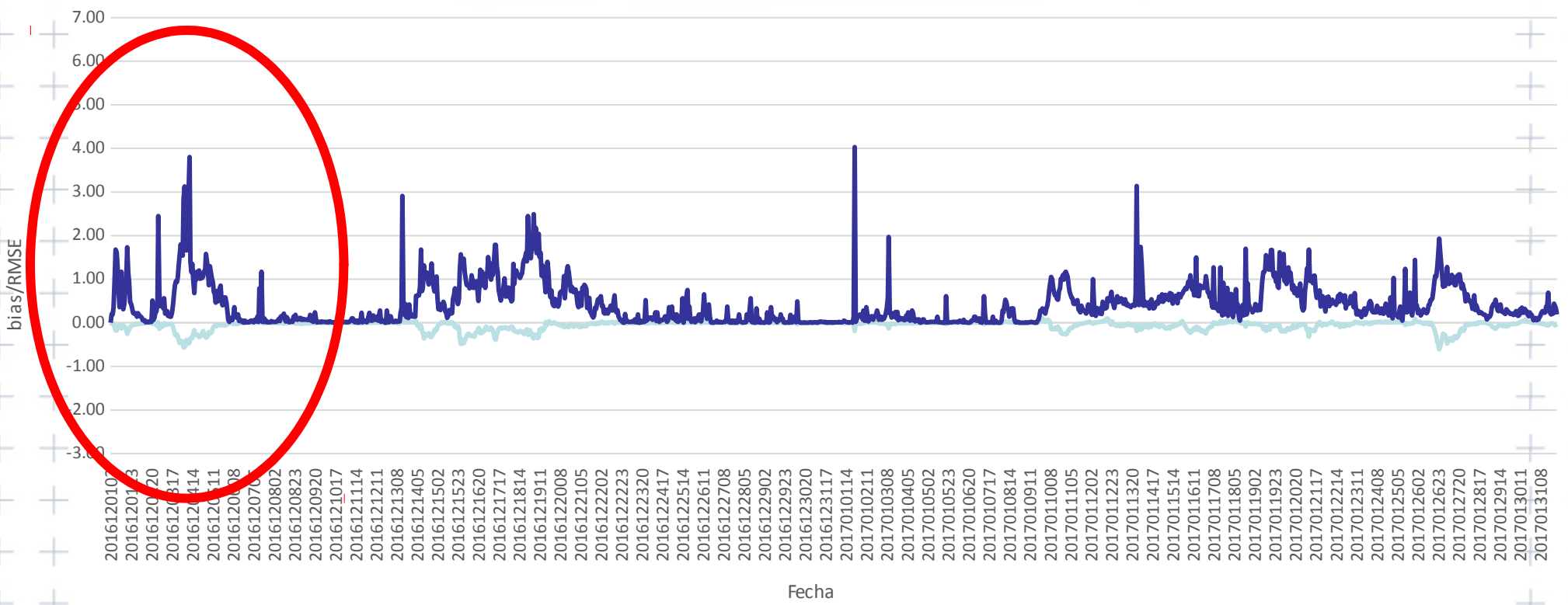
## Number of data



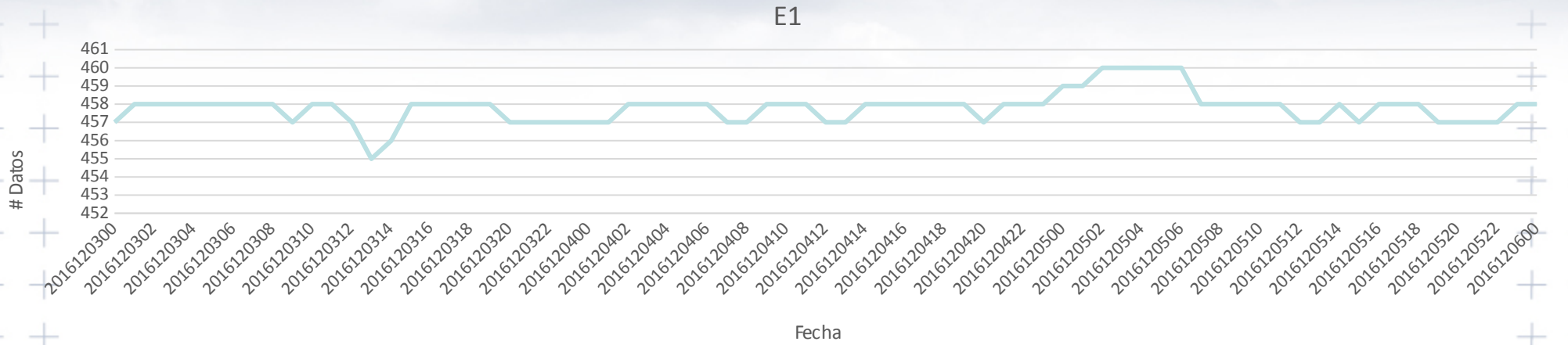
# OPERA – Obs – Acc Precip 1 h



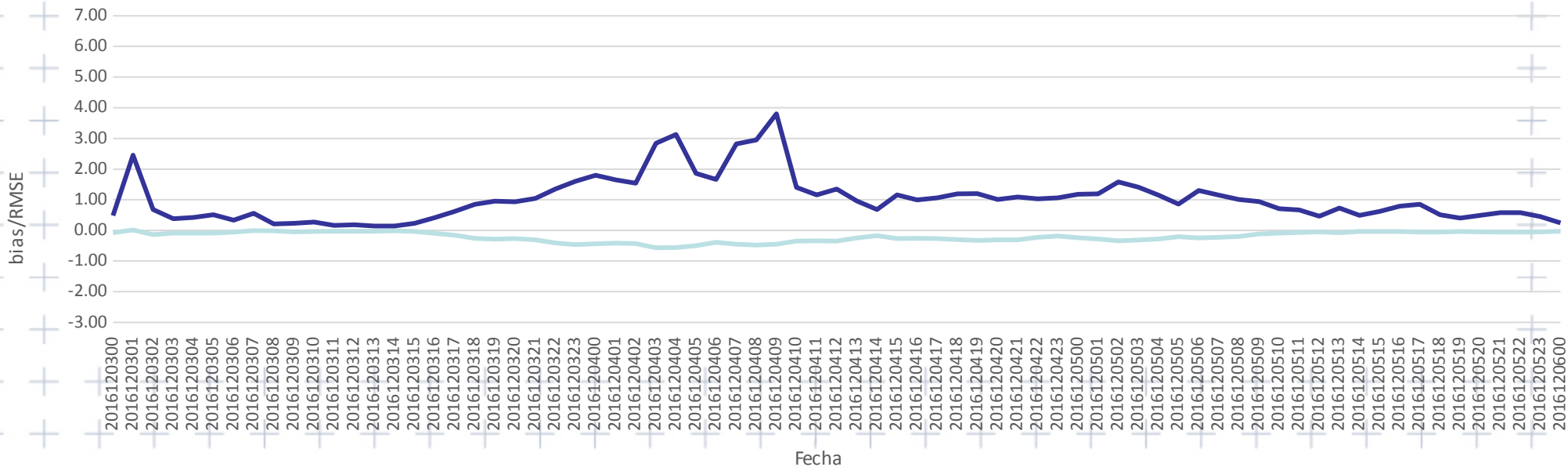
OPERA 2016120100 2017013123 --> E1 --> # = 678425 -- bias = -0,05 -- rmse = 1,02



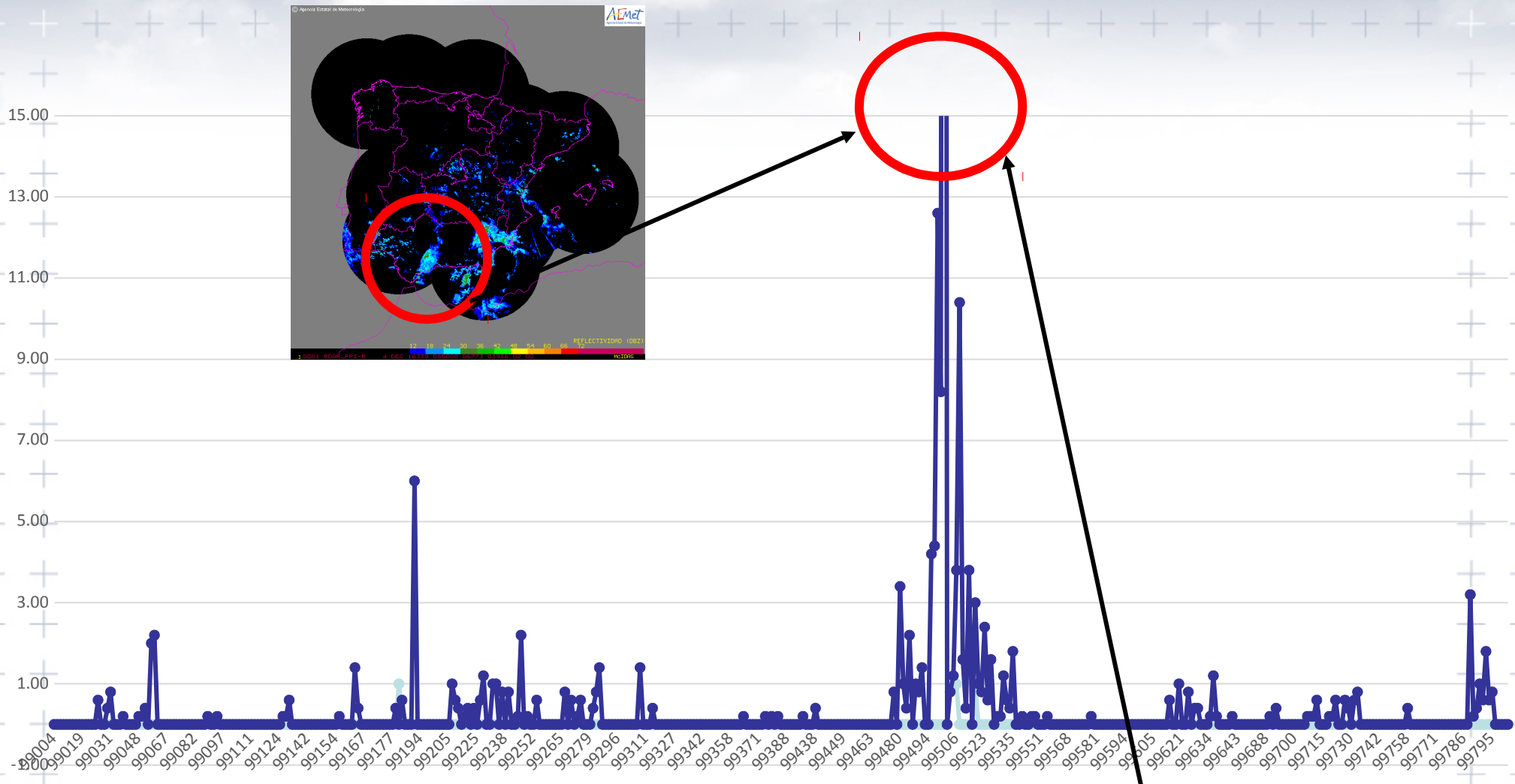
# OPERA – Obs – E1 Zoom – 2016120300 - 2016120600



**OPERA 2016120300 2016120600 --> E1 --> # = 678425 -- bias = -0,05 -- rmse = 1,02**



# OPERA – Obs – E1 - 2016120409



Obs

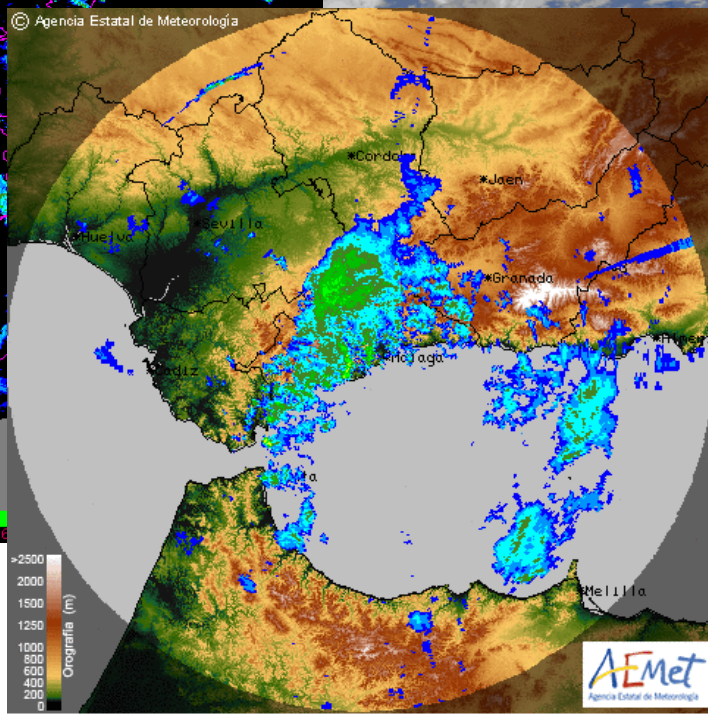
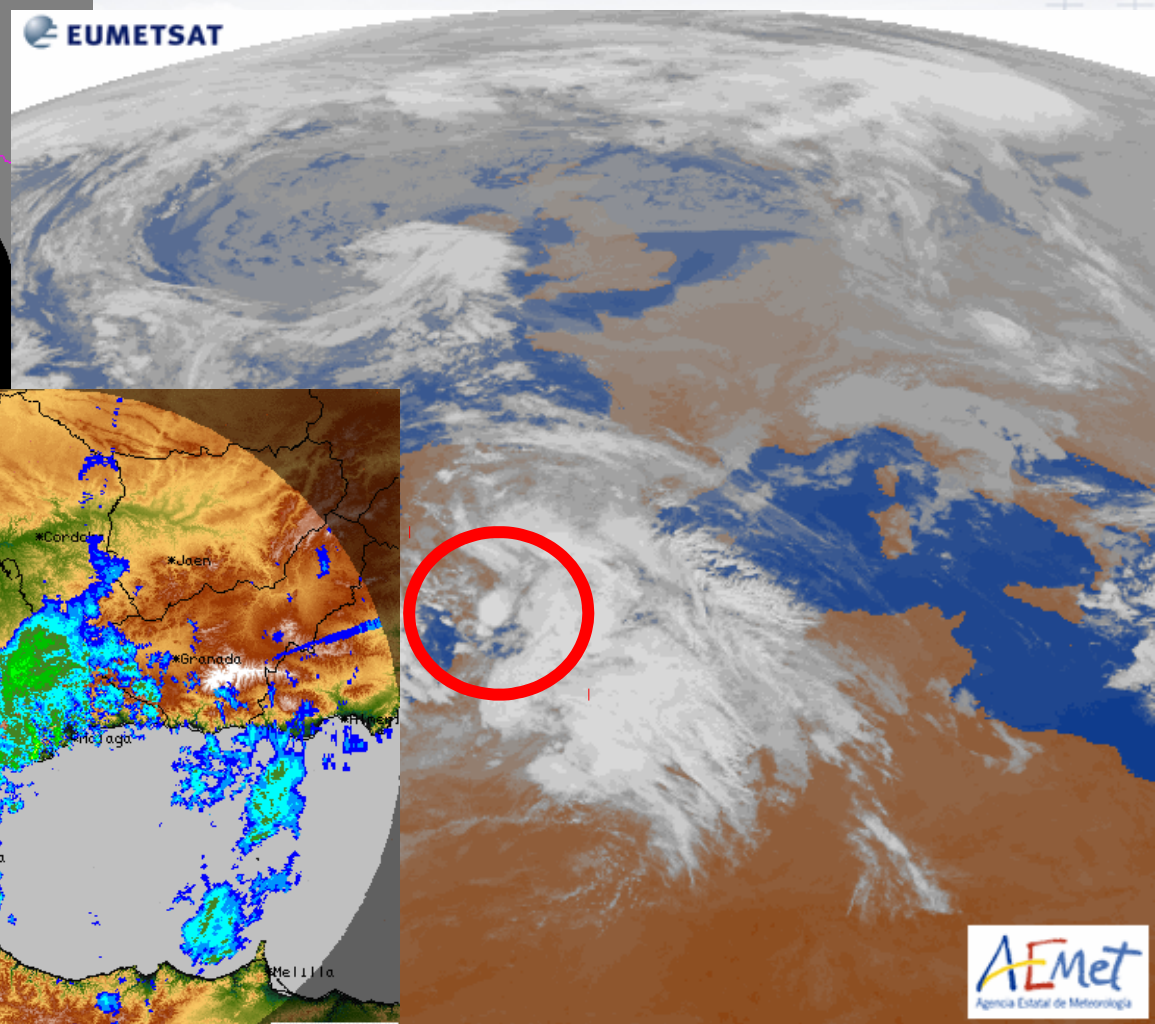
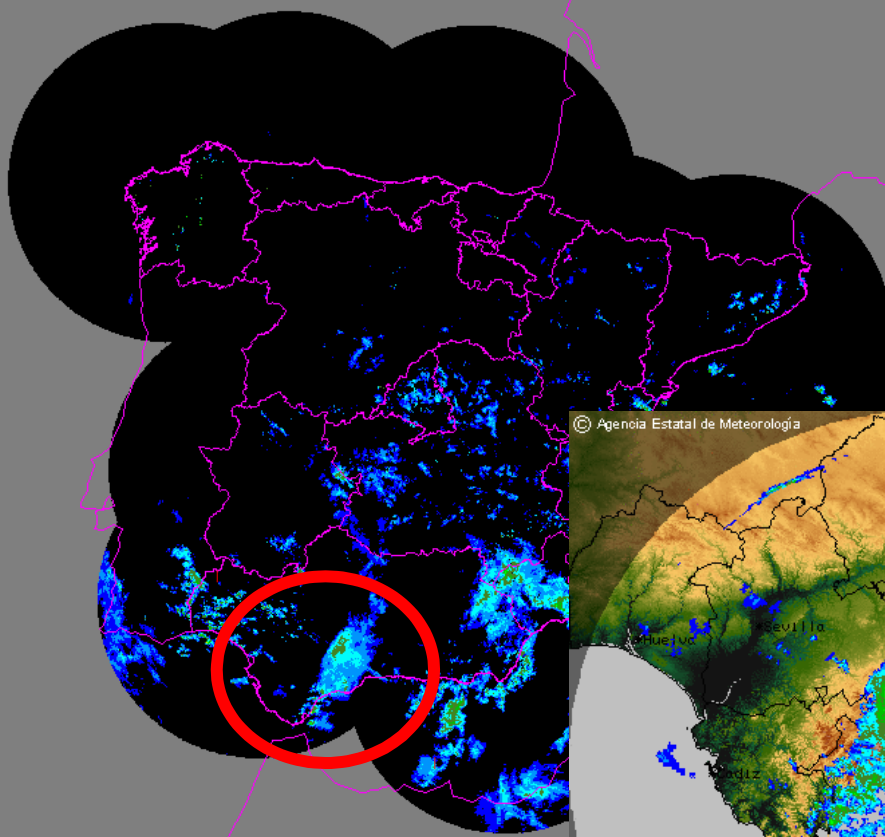
99500 36,5 N 5,0 W 78,00

# Radar / Meteosat IR - 2016120409

© Agencia Estatal de Meteorología

AEMet  
Agencia Estatal de Meteorología

EUMETSAT

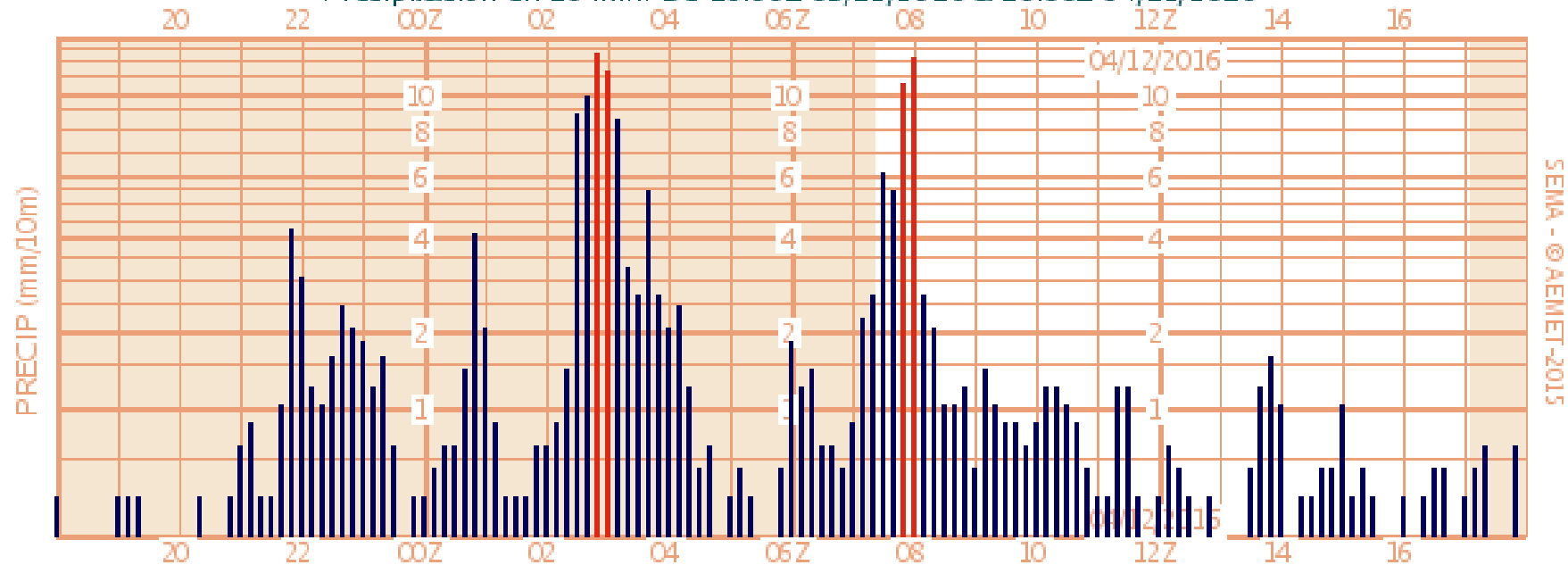


12 18 24 30 36 42  
1 0001 RDAR\_PPI-R 4 DEC 16339 085000 06773 08980

Reflectividad (dbz) 12 18 24 30 36 42 48 54 60 66 72  
 Radar de Málaga 1 0001 RDAR\_PPI-R 4 DEC 16339 090000 07955 09244

# Precip mm/10' – Obs 6069X

Estación 6069X - BENAHAVIS (LA ZAGAleta - AUTOMATICA) (MÁLAGA)  
Precipitación en 10 min. De 18:00z 03/12/2016 a 18:00z 04/12/2016



SEMA - © AEMET-2015



# OPERA\_ZMAX – Obs - Monitoring

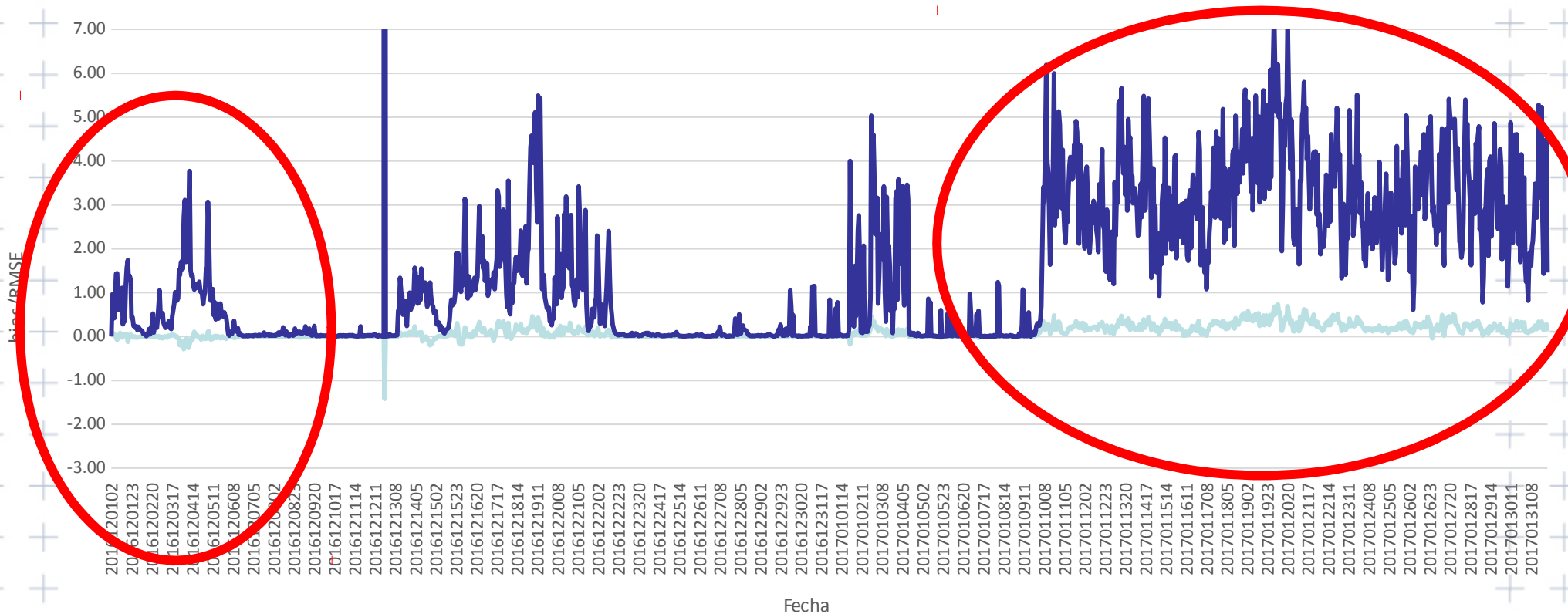
OPERA	2016120100	2017013123	
Pormedio	# Datos	Bias	RMSE
E1	678425	-0.05	1.02
E3	676983	-0.16	1.78
E6	674008	-0.32	3.18
E12	668014	-0.63	5.59
E24	655921	-1.30	9.41

HYDROP	2016120100	2017013123	
Pormedio	# Datos	Bias	RMSE
E1	690572	0,05	1,23
E3	689296	0,16	2,60
E6	686610	0,31	4,82
E12	681234	0,63	9,05
E24	670580	1,27	16,94

OPERA_ZMAX	2016120100	2017013123	
Pormedio	# Datos	Bias	RMSE
E1	690918	0,10	2,38
E3	690509	0,31	6,39
E6	689080	0,63	12,40
E12	686183	1,22	23,44
E24	680283	1,66	23,41

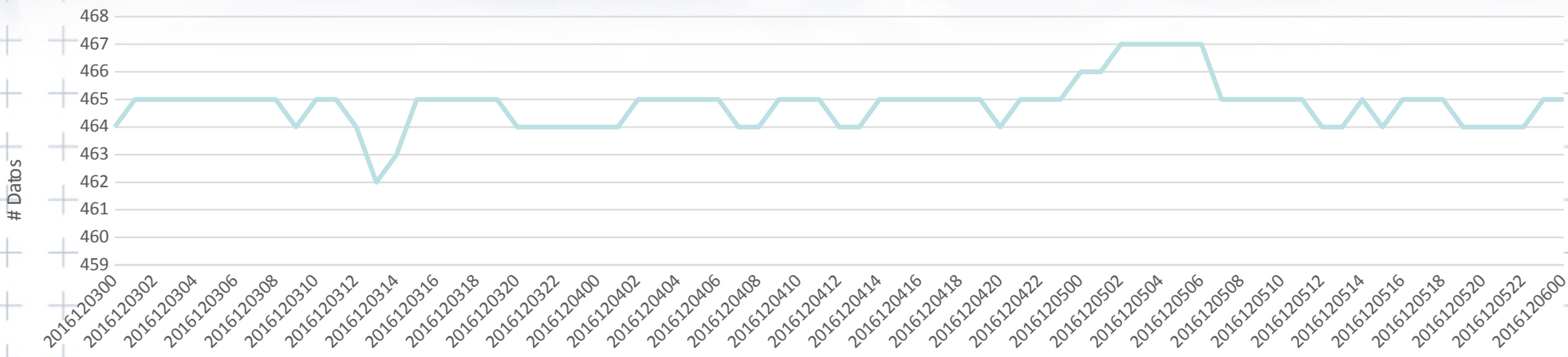
# OPERA\_ZMAX – Obs – Acc Precip 1 h

OPERA\_ZMAX 2016120100 2017013123 --> E1 --> # = 690018 -- bias = 0,10 -- rmse = 2,38

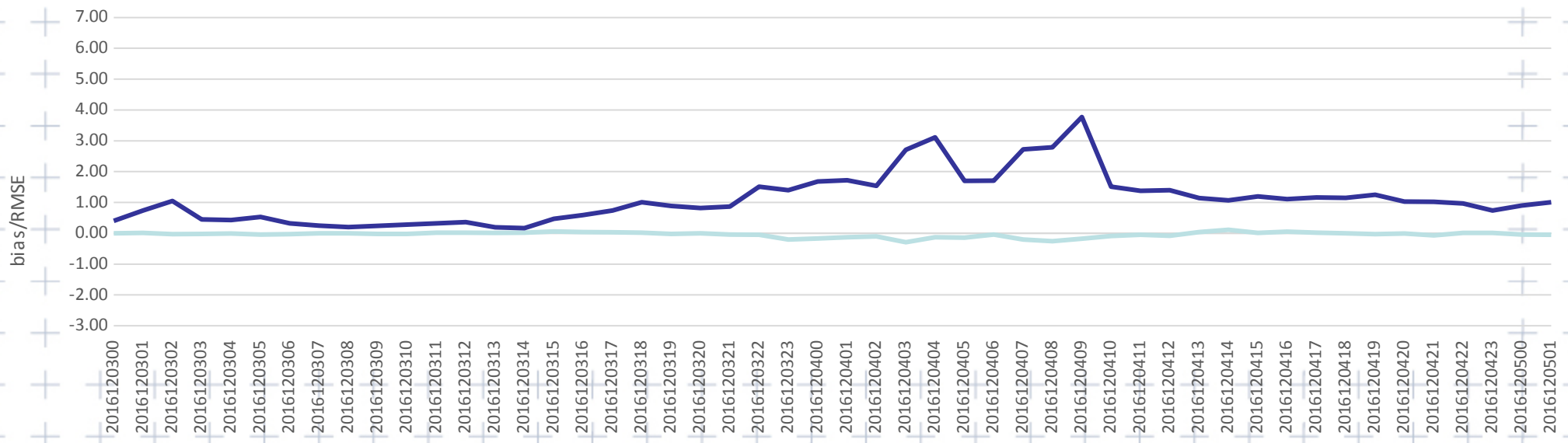


# OPERA\_ZMAX – Obs – E1 Zoom – 2016120300 - 2016120600

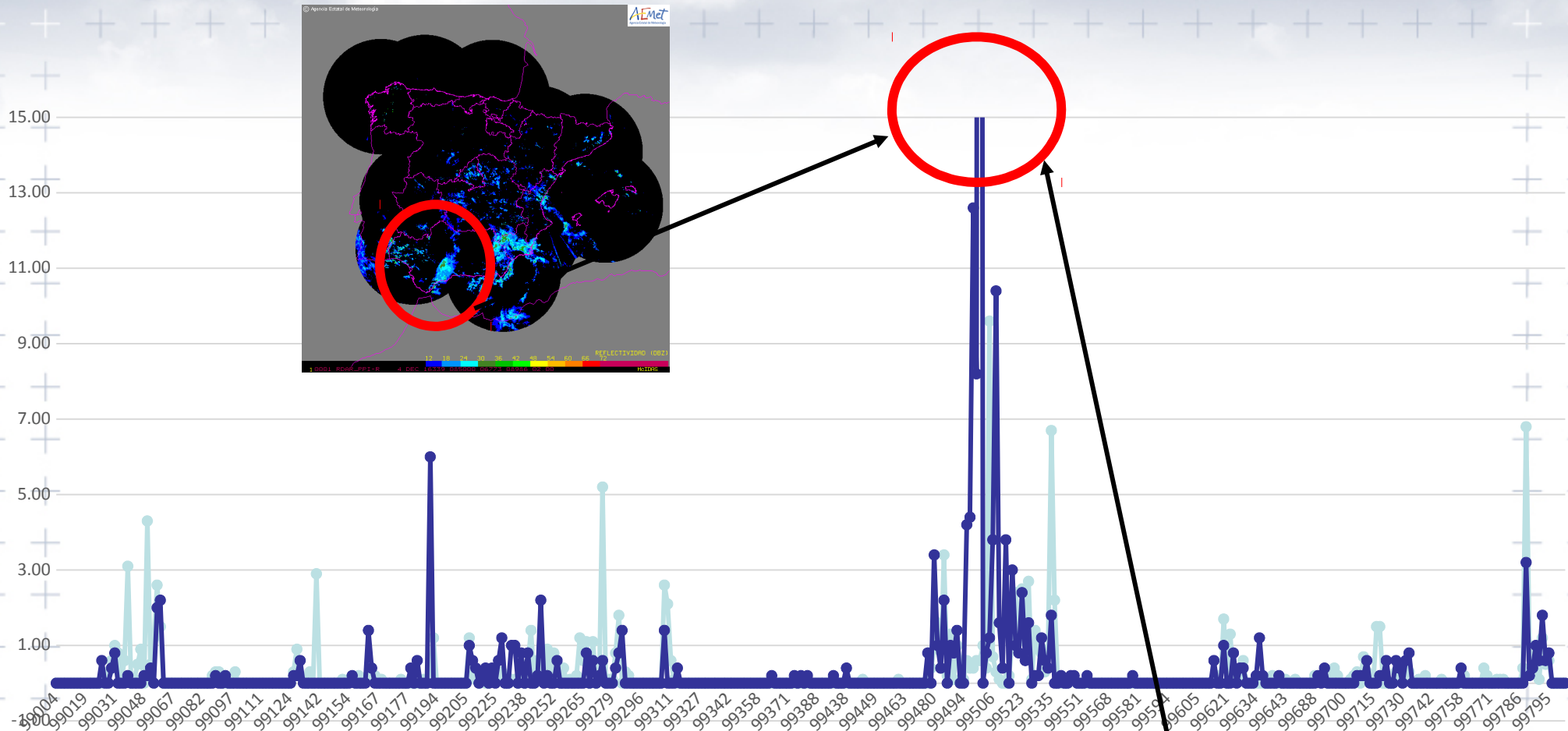
E1



OPERA\_ZMAX 2016120100 2017013123 --> E1 --> # = 690018 -- bias = 0,10 -- rmse = 2,38

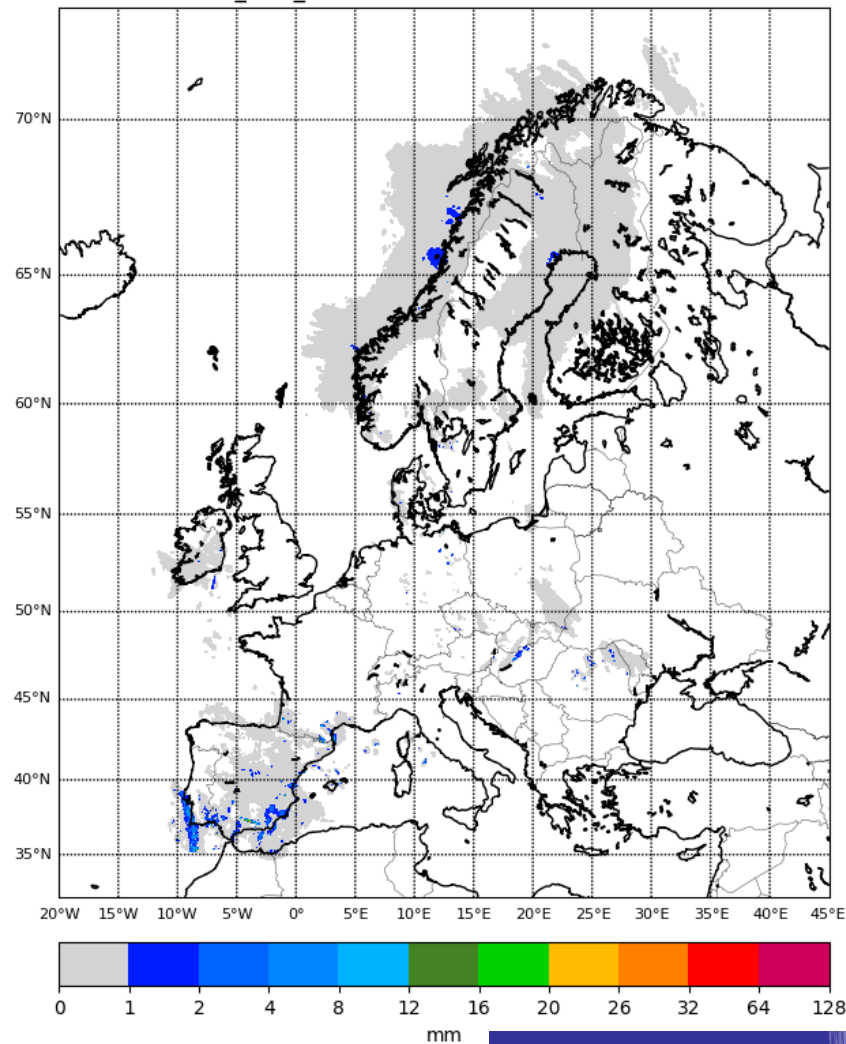


# OPERA\_ZMAX- Obs - E1 - 2016120409



# OPERA – Obs – E1 - 2016120409

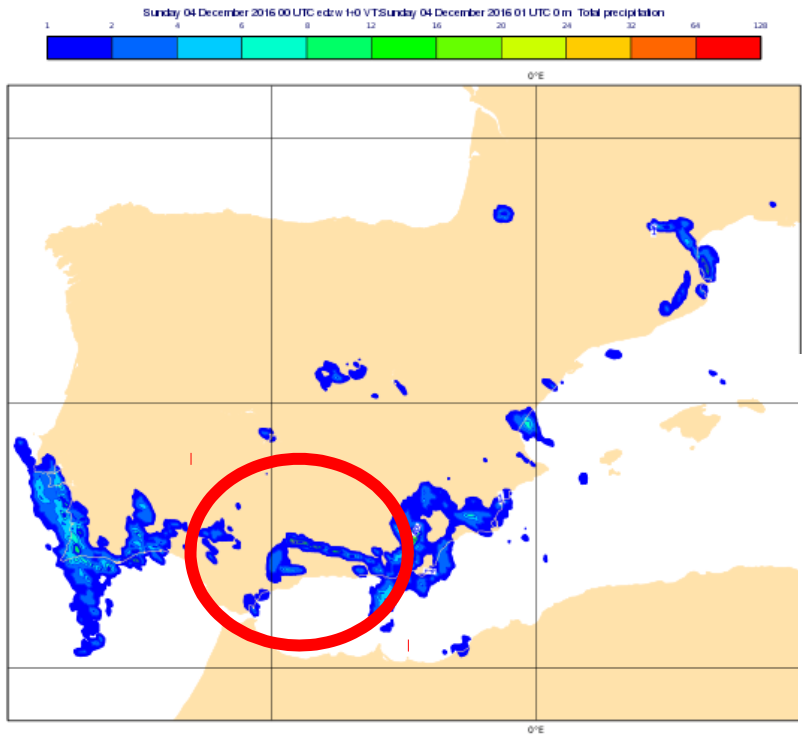
OPERA\_1HR\_PRECIP DATE: 20161204 HOUR: 0900



Obs

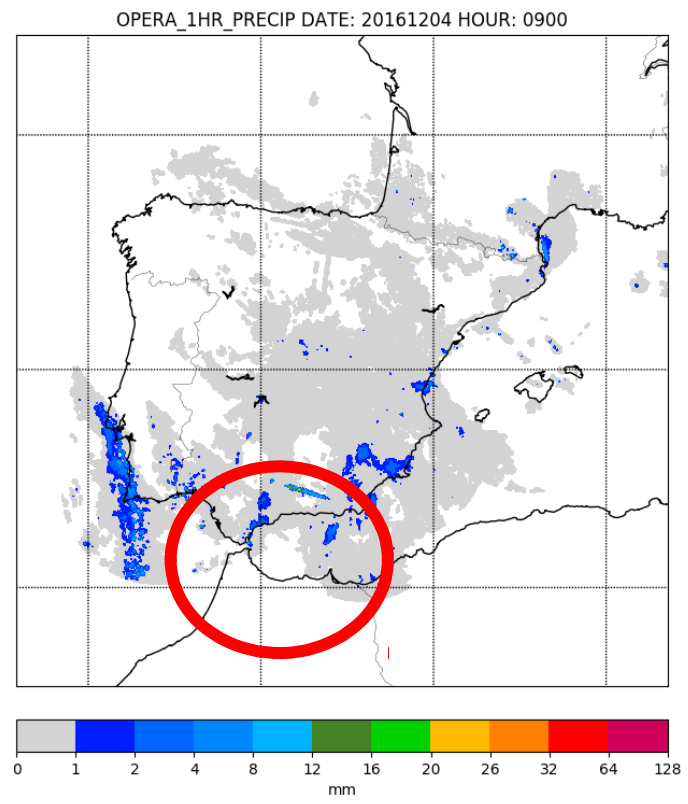
99500 36,5 N 5,0 W 78,00

# OPERA\_ZMAX - OPERA - 2016120409

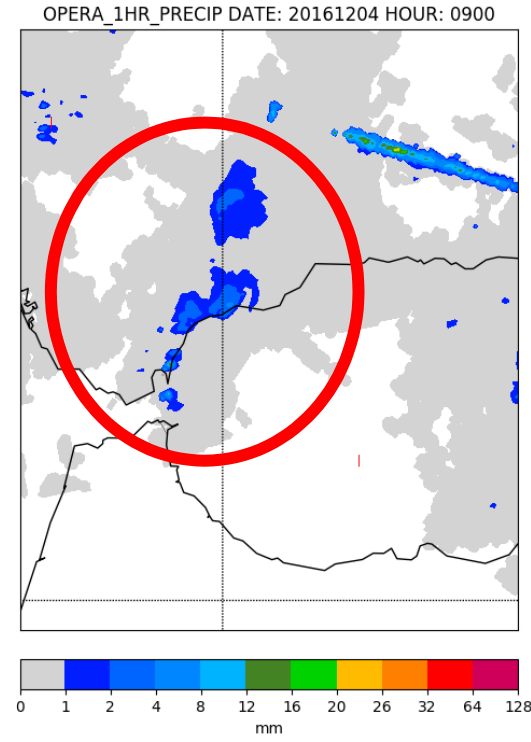
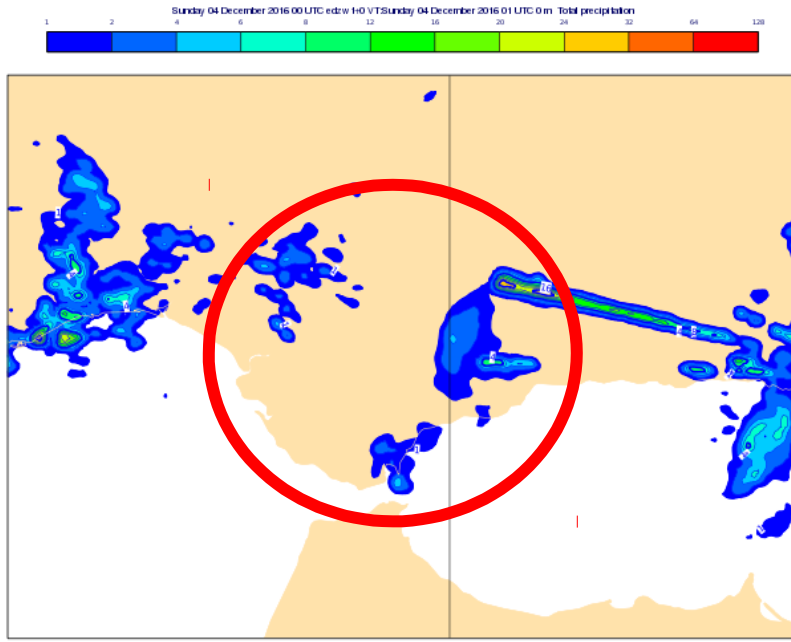


## ZMAX

## Opera



## Opera

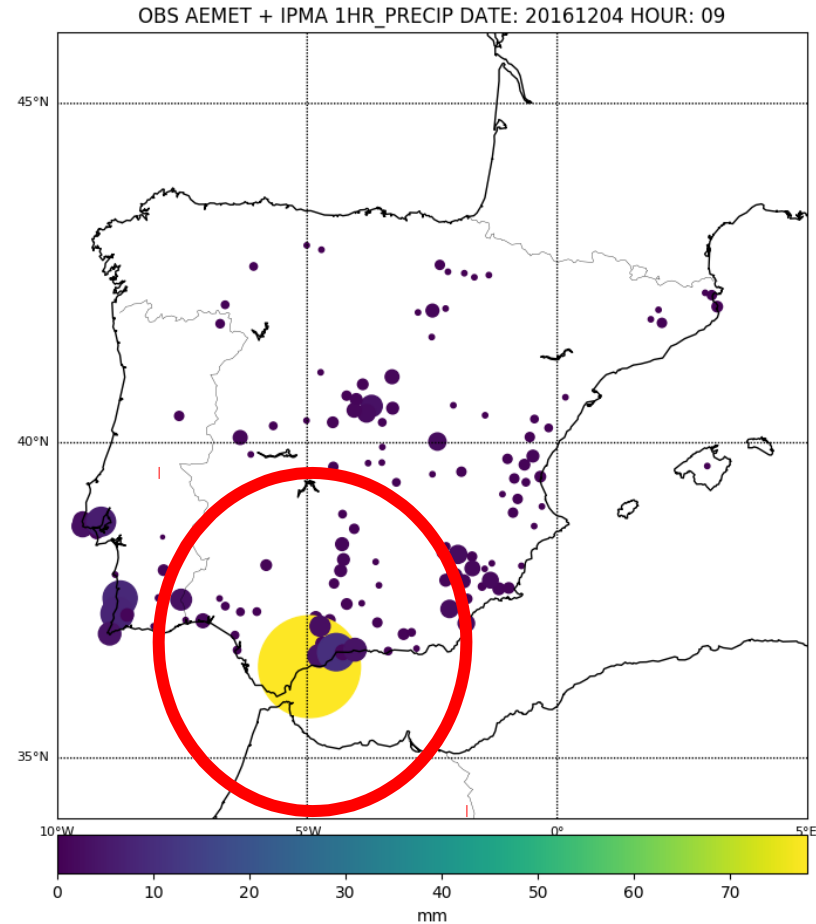
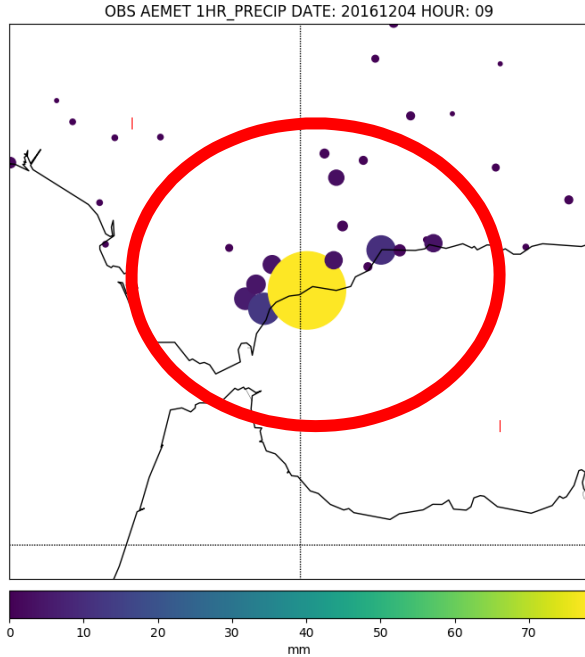
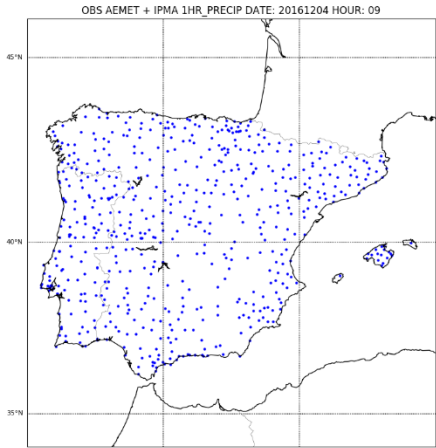


## ZMAX

**99500 36,5 N 5,0 W 78,00**

## Obs

# Obs. AEMET+IPMA - 2016120409 - zoom

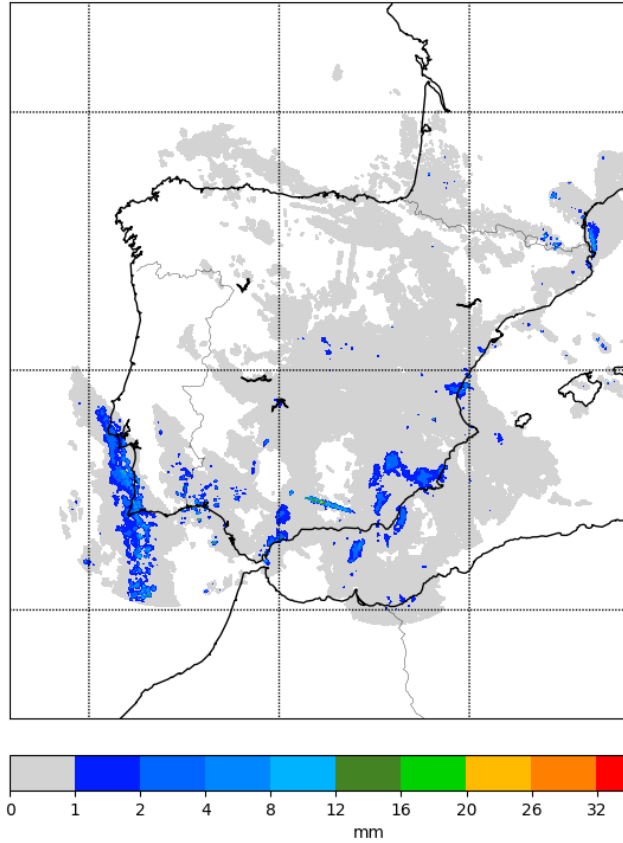


**99500 36,5 N 5,0 W 78,00**

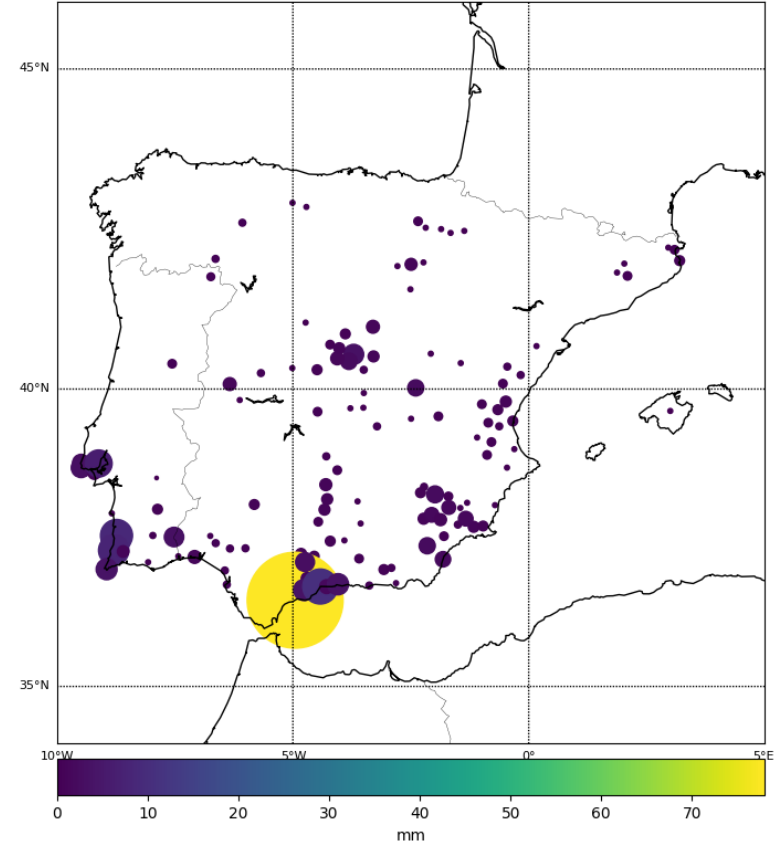


# Obs. AEMET+IPMA - 2016120409

OPERA\_1HR\_PRECIP DATE: 20161204 HOUR: 0900



OBS AEMET + IPMA 1HR\_PRECIP DATE: 20161204 HOUR: 09



# Conclusions

- Precipitation from Radar Reflectivities are smaller than observations.
- Precipitation based in Z\_MAX also improves maximum amounts but scores are further worse on average (double penalty).
- Still too early to use in NWP and EPS verifications.
- But spatial ( ~2 Km) and temporal (1 hour acc. Precip. Every 15 minutes) resolutions, and domain (whole Europe) make this product very useful (when improves) for Mesoscale Models validation.
- Having precipitation data in spatial structures is more convenient for mesoscale verification methods (SAL) than having pointwise observations.